Risk-based prioritisation of ground water threatening point sources at catchment and regional scale

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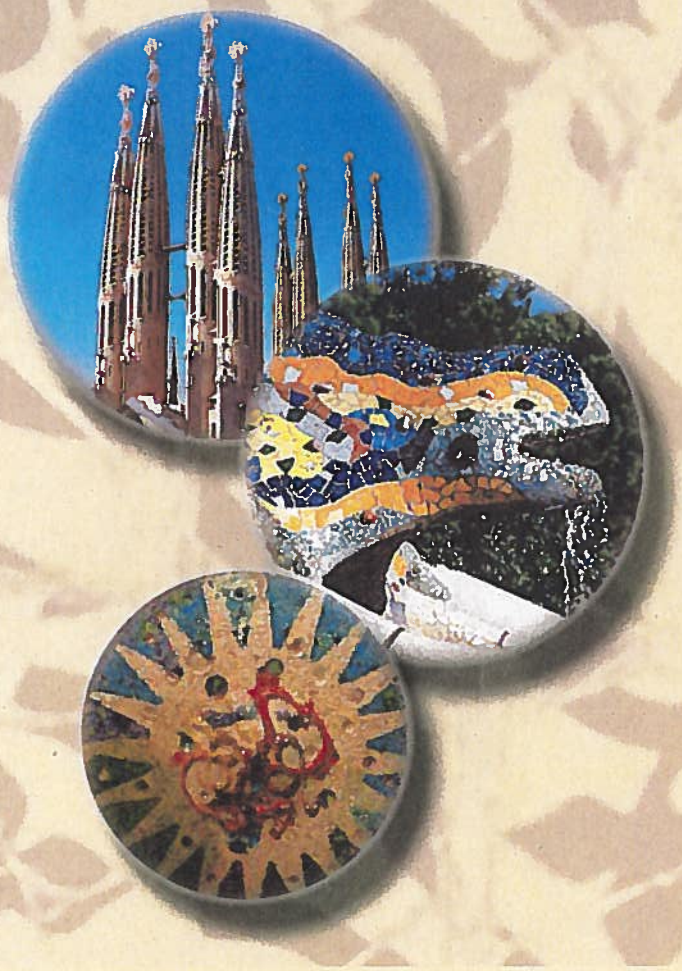

PROGRAMME • BOOK OF ABSTRACTS

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The presentation will focus on the requirements for sustainable ecosystem services management, in which the scale considered is very important. Decision making based upon ecosystem services is best accomplished at the scale of the landscape (e.g. Van Wensem, 2012 in prep.). This implies the need of knowledge of the soil and groundwater system at the regional and local scale.

References

TCB, 2012. Advice groundwater. A074 (In Dutch).

EFSA European Food Safety Authority 2010. Scientific opinion on the development of specific protection goal options for environmental risk assessment of pesticides, in particular in relation to the revision of the Guidance Documents on Aquatic and Terrestrial Ecology. EFSA 2010;8(10): 1821.

Van Wensem, in prep. Use of the ecosystem services concept in landscape management in the Netherlands (submitted to Integrated Environmental Assessment and Management).

ThS E2 - Regional management of soil-water systems

Wednesday | 17 April | 11.00-12.30 | Lecture hall 5

THE LONG WAY OF IMPLEMENTING RIVER BASIN MANAGEMENT IN POST-SOVIET STATES - CONFLICT ANALYSIS IN THE WESTERN UKRAINE

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The Ukraine as one of the former Soviet republics aims at implementing a river basin management approach. The Western Bug River catchment with its transboundary relevance in the Western Ukraine serves as an example to outline existing conflicts between different sectors such as agricultural, mining, industrial and domestic wastewaters usage in contrast to drinking water purposes. Future prognosis sees the catchment under even further increased hydrological stress due to global climate and socio-economic changes. The catchment furthermore faces severe water quality problems due to sewage discharges from poorly performing treatment facilities particularly affecting the main tributary of the Western Bug, the Poltva River. On the other hand, positive implications on the water quality and a high potential of the rivers self-purification can be assumed due to its widely unmodified hydromorphological state. Both, the preservation of these positive implications as well as the negative impact factors have to be managed in an integrated way.

Based on field and interview surveys in the case study area, the paper aims at outlining the most important impact factors on the water quality in the Western Bug River catchment and to identify the current management structures. The concept of scales is used to structure the analysis and to provide a theoretical foundation for the explanatory approach. Based on this analysis, gaps between influencing factors and engaged actors are identified and proposals to optimize the management scales are derived accordingly.

The results of the field surveys provide a detailed picture of the main areas of concern such as high wastewater loads, implications from mining and agricultural land use. Furthermore, the interview survey sheds light on the fact that all the identified problem fields are managed by different official water authorities with partly overlapping responsibilities which are incompatible with the geographical catchment boundaries.

RISK-BASED PRIORITISATION OF GROUND WATER THREATENING POINT SOURCES AT CATCHMENT AND REGIONAL SCALE

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A large number of point sources threaten ground water resources worldwide. The available resources for investigation and remediation are limited compared to the scope of the problem. Thus, prioritisation is crucial to ensure that resources are allocated to the sites posing the greatest risk.

During recent years we have developed a flexible framework to enable a systematic and transparent risk assessment and prioritisation of point sources, considering the local, catchment, or regional scale (Danish EPA 2011, 2012). The framework integrates site-specific mass discharge calculations (Troldborg et al. 2008; Chambon et al. 2011) and site-uncertainty estimates, with optional catchment-scale fate and transport modelling (Troldborg et al. 2008) to evaluate time-dependent or stationary impacts on extraction wells or other receiving waters. Prioritisation is supported by a flexible scoring system adapted from the widely used DRASTIC method (US EPA 1987). Standardised GIS-themes and tables give authorities a transparent platform for prioritising their efforts and for external communication.

The framework has been tested in several catchments in Denmark with different challenges and needs, and two of these will be presented. One case study is a densely populated area of about 110 km^2 in Greater Copenhagen with heavy contaminant load from several hundred potentially hazardous sites and large ground water extraction. The analysis showed that a number of waterworks were acutely or potentially threatened by chlorinated solvents, and recommendations included prioritised actions at both local scale (e.g. site surveys or remediation) and on larger scale (e.g. monitoring or pumping strategies). The other case study is a rural area of about 40 km^2 with a low density of potentially hazardous sites but with a highly prioritised ground water resource. The combined impact on the ground water resource was evaluated, and it was assessed that no further efforts were needed to secure the ground water quality under current conditions.

Based on the lessons learned, the Danish EPA has prepared a handbook to guide the user through the steps in a risk-based prioritisation (Danish EPA 2012). It provides guidance on prioritisation both in an administratively defined area such as a Danish Region, and within the bounds of a specified ground water catchment. The handbook describes a flexible "tool box" which can be tailored to suit a given problem and the available data, preventing the prioritisation from foundering because of lack of data or too high complexity. The developed prioritisation tools, possible graphical presentation and use of the results will be presented, using the case studies as examples.

The development has involved the Danish EPA, the Danish Regions (responsible for public actions towards contaminated sites), the Danish Nature Agency (responsible for the Danish water resource planning), the Technical University of Denmark as well as consultants – thus there is a general acceptance of the framework in the professional community in Denmark. We believe that the concepts can also be applied in other European countries with similar challenges.

References
Chambon, J.C., P.J. Binning, P.R. Jørgensen and P.L. Bjerg: A risk assessment tool for contaminated sites in low-permeability media, J. Contam. Hydrol. 124, 82-98
Danish EPA, 2011: Tools for Risk Assessment and Prioritisation of Ground Water Threatening Contamination. Environment Project no. 1366, 2011 (In Danish).
Danish EPA, 2012: Handbook for Risk-Based Prioritisation of Ground Water Threatening Point Sources (In Danish). In print.
Troldborg, M., Lemming, G., Binning, P.J., Tuxen, N., Bjerg, P.L., 2008: Risk assessment and prioritisation of contaminated sites on the catchment scale. J. Contam. Hydrol. 101 (1-4), 14-28.
US EPA, 1987: DRASTIC: A standardized system for evaluating ground water pollution potential using hydrogeological settings.

CONTAMINANT TRANSPORT MODELLING IN SOILS AND SUBSOILS IN URBAN ENVIRONMENT – TOOLS AND PRACTICAL USES IN FRANCE

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Urban soils and basement are subjected to strong pressures because of the human settlements and activities, as well as the increasing urbanisation. Local authorities have to face problems of sustainable management of their territory, with the aim of preserving soil and water resources. They need to recover potentially urbanisable zones and rehabilitate polluted sites. The questions of soil and underground pollutions appear therefore as an integrated part of the urban land management.

Models and codes of calculation have been developed to simulate the flows andor the reactive transport of pollutants in soils and underground. The modelling allows to understand the behaviour of pollutants and to predict their future. It appears as an important tool for the questions of management and development in urban zones. Its use often appears as a specialists' affair.

The project OPUSS (Contaminant transport modelling in soils and subsoils in urban environment), aimed at analysing the existing tools, their practical uses in France and their potentiality to be used or adapted to urban zones. It takes into account the wide scope of pollutants met in urban zones.

Besides an international bibliographical synthesis including the specificities of the urban environment and socio-economic aspects, the project analysed the existing modelling tools. The literature survey was completed by a user's survey and contacts with the developers. This information allowed to synthetize the functionalities of the main modelling tools in descriptive charts, to compare the tools and to propose recommendations.

The literature survey shows that pollutants can be generated by the industrial or domestic activities, as well as by the activities of transport and maintenance. They divide up between the various phases of the soil and subsoil (solid, liquid, gas). Their mobility is governed by various physico-chemical processes of transport and retention / liberation. In this frame, the water appears as an important vector of migration, in particular from soils towards groundwater. The specificities of the urban environment, in particular its heterogeneousness and its complexity, also influence the transport of pollutants. This leads to non-uniform transfer and retention capacity.

Regarding the available modelling tools, they appear mainly concentrated on the comprehension of the physical system. Nevertheless, the methods of socio-economical evaluation get more and more integrated in the modelling work. It is largely recognised indeed that the pollution of soils and water does not only concern processes of transfer. It deals also with socio-economic aspects, linked for instance to human behaviour and to the research of management solutions.

Regarding the practical uses in France, only few of the large variety of existing tools appear to be used. Mainly applied at site scale, they generally consider uniform systems (continuous, isotropic) in porous environment. Heterogeneities (simple) appear nevertheless regularly taken into account. Coupling with geographic information (GIS) system occurs rarely. Flow processes are taken into account, whereas physico-chemical processes appear often limited to adsorption represented by a Kd. This is due to limited capacities of the tools used for modelling. The lack of field data, underlined by most users, prevents from validating the built models.

This multidisciplinary operational and integrated approach brings into the light the possibilities and the limits of the existing modelling tools, as well as their possible improvements to allow the sustainable management of the diffuse urban pollutions. Several questions rise like the scale of work to use modelling as decision aid tools to develop and manage urban soils and undergrounds, and more widely the urban territory.

A WEB-BASED PLANNING SUPPORT TOOL FOR SEDIMENT MANAGEMENT IN A MESO-SCALE RIVER BASIN IN WESTERN CENTRAL BRAZIL

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A central element of river basin management in scope of IWRM for the Federal District, Western Central Brazil is a planning support tool that enables the user to test the effects of land use and land cover change (LULCC) on landscape processes and functions (LPF) important for sediment generation and retention. For this purpose we developed the web based tool *Letsmap do Brasil*. The tool has two principal interacting layers. The upper layer contains information on effects of land use on LPF, i.e. water retention, sediment retention, nitrogen retention and agronomic value. The parameterized relation between land use and LPF is the core of the system. For each LPF a value specific to land use has been assigned. By creating their own land use/cover pattern users are enabled to test effects of land use/cover change on LPF´s. A second layer contains information on landscape properties and potentials (LPP), e.g. potential of runoff control or the potential of sediment retention from the river network. By linking land use and LPP´s the system provides a site specific assessment of effects of LULCC on LPF. *Letsmap do Brasil* is thought to fulfill two purposes. (i) It will support decision making in river basin management and sediment management. (ii) It enables non-experts to participate and trains non-experts in decision processes. Because of its high adaptability, transparency, and simple handling Letsmap do Brasil might be used as a universal tool in river basin management and land use planning.